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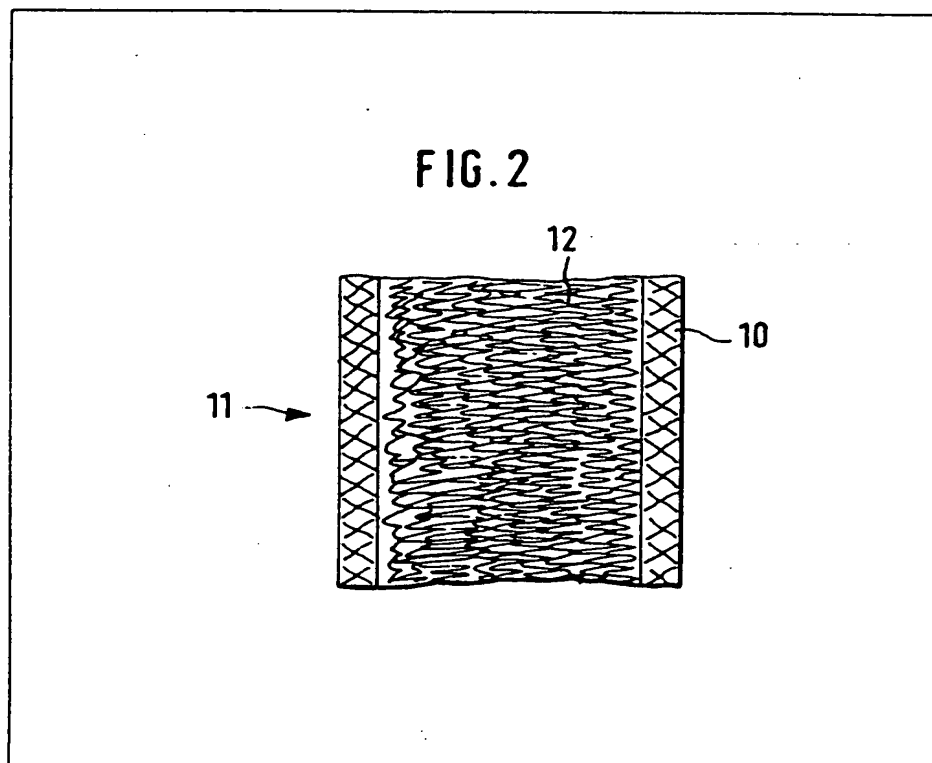
(54) Surgical stitching thread

(57) Surgical stitching thread, has a sheathing (10) in the form of a tubular braided structure, which is braided from a number of multifilament yarns, each of which consists of smooth

uncrimped filaments. For reducing the surface roughness of the sheathing the number of bobbins is increased for the braiding process and the number of braids of the sheathing per axial length is reduced.

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FIG. 2

SPECIFICATION

Surgical stitching thread

The invention relates to surgical stitching thread having a tubular braided sheathing composed of a plurality of multi-filaments each of which consists of smooth uncrimped filaments.

- 5 Surgical stitching threads of this kind consist of the sheathing alone or of the sheathing and of a core round which this sheathing is wound. The multifilament yarns which are braided together to form the sheathing consists of synthetic plastics filaments which can decompose in the human body (e.g. polyglycolic acid) or synthetic plastics filaments which cannot decompose in the human body (e.g. polyester, polyamide, polypropylene) and/or metal filaments. Filaments of the same materials as for the hitherto known surgical stitching thread can be used for the stitching thread according to the invention. However, filaments from other materials may possibly be considered, in particular materials which are used in the production of synthetic fibres. By "filament" is meant an elongate structure such as can be formed, in the case of synthetic plastics materials, viscose or the like, by means of a hole of a spinning nozzle (spinnaret) or multiple spinning nozzle and, in the case of metal, by means of a hole of a drawing die of a drawing tool. Filaments of synthetic plastics material, viscose or the like are also referred to as endless chemical fibres, elementary fibres or capillaries.

By the hereinafter used term "braid number Z" is meant the number of braids present on a generatrix (also called "edge"), extending axially parallel to the longitudinal axis of the stitching thread, per French inch (equals 27.07 mm).

- 20 The following symbols and expressions are used hereinafter:
 Z = The number of braids in accordance with the above definition.
 K = the number of bobbins (number of bobbins which — in the course of braiding the sheathing — delivered the multi-filament yarns (braiding yarns) which form the multi-filament yarns).
 Multifilament yarn = a yarn in the form of a number of filaments.
 25 GT = the count (titre) of the individual yarn, also referred to hereinafter as "individual count", in dtex.

N = the number of yarns of which the core consists.

F = the number of filaments of a multifilament yarn

- 30 USP-size = diameter ranges of surgical stitching threads in accordance with United States Pharmacopoeiae XIX, pages 486, 665, Pharma Copiae Convention Inc. Meeting at Washington D.C. April 1970, 12601 Twinbrook, USA.

The tubular braided structures of such surgical stitching threads have hitherto been formed with a large number of braids and, in comparison with this a small number of bobbins, and the multifilament yarns which are braided together each had a relatively large individual count (titre); the filaments of the individual yarns also had a relatively large count or titre. Table 1 appended to the end of the specification contains the combinations of values, pertinent to this, of the surgical stitching threads used up to the present time.

- 35 Insofar as these known surgical stitching threads had a so-called core, the latter consisted of a ply yarn, which was formed from a number of filament yarns by twisting the latter round one another; the filaments of this ply yarn were uncrimped.

- 40 The sheathing forming the outside surface of the surgical stitching thread has relatively high roughness in the case of the numbers of bobbins and numbers of braids which have hitherto been conventional. The result of this, when stitching human or animal tissue by means of these known surgical stitching threads, has been that the stitching threads can cut into the tissue, in the manner of a saw, and thus enlarge the wounds, and delay the healing process. Also, this rough sheathing increases the force required for pulling the surgical stitching thread through the tissue, which makes it more difficult to perform the stitching operation in a sensitive manner.

- 45 It is therefore an object of the invention to provide a surgical stitching thread of the type defined at the outset, the outside surface of whose sheathing can be made with lower surface roughness than the surgical stitching threads, made from the same base material, of the same USP size according to Table 1.

- 50 According to the invention therefore for the purpose of reducing the surface roughness of the sheathing — the number of bobbins, when braiding the sheathing, in comparison with the known surgical stitching threads, specified in Table 1 of the same diameter range (USP size) is increased, whilst the number of braids of the sheathing in comparison with these known surgical stitching threads is decreased.

- 55 To increase the number of bobbins and reduce the number of braids, the outside surface of the surgical stitching thread becomes smoother, that is to say it becomes less rough than is the case with the hitherto conventional stitching threads made from the same basic material and of the same USP size as set forth in Table 1. Consequently, it is possible to pull these surgical stitching threads through human or animal tissue with less force, so that the surgeon can stitch with more sensitivity than hitherto. Also, the human or animal tissue is damaged to a lesser extent by these surgical stitching threads, and so the healing process of the wound is also facilitated.

The individual counts (titres) GT of the yarns of the sheathing of the stitching thread according to

the invention are, due to the increased number of bobbins, smaller than those of the known stitching threads of the same USP size as set out in Table 1.

The material of the filaments of the sheathing of the surgical stitching thread may consist of the materials which have already been referred to above, preferably of synthetic plastics materials, for example polyester, polypropylene, polyglycolic acid or also of other suitable materials, such as for example viscose silk, natural silk, metal or the like.

The diameter of the surgical stitching threads according to the invention is, in particular, within the range of USP sizes 7—0 to 6. It will be appropriate if the stitching threads are without a core within the USP size range 7—0 and 6—0, and if the stitching threads comprise a core within the size range 4—0 to 6. In the intermediate range of USP sizes 5—0 and 4—0 it will preferably be optional whether the stitching threads contain a core or not.

If the stitching thread according to the invention contains a core, the structure and material of its filaments may be conventional, that is to say these filaments will consist of a ply yarn or of an individual yarn. However, in accordance with a modification of the invention, the core may consist of doubled (folded) multifilament yarns, that is to say these multifilament yarns extend parallel to the longitudinal axis of the stitching thread and are not twisted round one another, that is to say they do not form a ply yarn. Also, in the case of the known surgical stitching threads having a core, the filaments of the core were always uncrimped. This may also be the case with the surgical stitching threads according to the invention. However, in accordance with a modification of the invention, at least some, and preferably all, filaments of the core are crimped, as in this way the surgical stitching thread may be made more pliant, so that its stitching performance and compatibility can be further improved.

Generally speaking, it will be satisfactory if the core consists of one or more multifilament yarns. However, in special cases, the core may consist of a single monofilament or of a number of filaments (viz. monofilaments) which are not twisted round one another, that is to say they are doubled (folded). Conveniently, with a view to ensuring that, in this case, the stitching thread has good qualities of pliability and circularity, the monofilament or monofilaments may consist of elastomeric material, preferably of silicone rubber or elastomeric polyurethane.

Preferred bobbin numbers K and braid numbers Z of the tubular sheathing of the surgical stitching threads according to the invention are specified in claims 2 to 13. The surgical stitching threads specified in claims 14 to 25 result, in practice, in optimally smooth surfaces allied to good qualities of pliability and to other favourable properties of the stitching thread.

The yarns (braiding yarns) used for braiding the sheathing of the surgical stitching thread have, in consequence of the higher bobbin numbers and of the lower braid numbers used for the braiding process, smaller individual counts GT than in the case of the hitherto conventional surgical stitching thread set out in Table 1. Multifilament yarns with the highest possible number of filaments have been found to be particularly favourable for braiding the sheathing of the stitching thread according to the invention.

In Table 2, appearing at the end of the specification, preferred structural data are given for a number of surgical stitching threads constituted in accordance with the invention; the numbers K of bobbins and numbers Z of braids in accordance with the preferred embodiments as specified in Claims 14 to 25 appear in this table. The individual counts GT, given in Claims 26 to 29 and in Table 2, of the multifilament yarns forming the sheathings and cores are particularly favourable; similarly, the other structural data given for these surgical stitching threads are also particularly favourable.

Normally, when the sheathing is being formed by braiding, one multifilament yarn runs from each bobbin of the braiding machine concerned to the braiding point. However, it is also possible, in the case of the surgical stitching thread according to the invention — and this may lead to a still more smooth surface of the stitching thread — to arrange for a number of multifilament yarns to run, in doubled (folded) fashion, to the braiding point, from at least one of the bobbins, preferably from all of the bobbins, so that the sheathing will be braided from a correspondingly greater number of multifilament yarns. As has already been mentioned, the multifilament yarns of the sheathing are uncrimped.

The smooth outer surface of the surgical stitching thread according to the invention is formed by the outside surface of the sheathing, which has been formed by braiding. Moreover, in special instances, provision may be made for providing the outside surface of the sheathing with preparations or the like for achieving special properties.

Further, it will be feasible in special instances, to replace at least one multifilament yarn of the sheathing by a monofilament or by a number of doubled (folded) filaments, that is to say filaments which abut one another in parallel fashion and are not twisted onto one another.

Embodiments of the invention are illustrated in the drawing, in which:

Figure 1 schematically represents a braiding machine for producing a surgical stitching thread constituted according to the invention, and

Figure 2 is a longitudinal cross-section taken through part of a surgical stitching thread in accordance with one embodiment of the invention; this stitching thread section is represented on a greatly enlarged scale.

The braiding machine 7 shown in Figure 1 comprises twelve bobbins 8, viz. yarn bobbins on which non-crimped multifilament yarns 9 are wound, these yarns 9 being braided so as to form the sheathing

10 (Figure 2) of a surgical stitching thread 11 to be produced on this braiding machine. The core 12 of this stitching thread, to be formed by braiding, consists of a number of doubled (folded) yarns 13 which, in this embodiment, are crimped multifilament yarns and are drawn off from bobbins 14 and commonly run to a yarn guide 15, pass through a thread brake 16, which is biased in a variable fashion, whence
5 the yarns 13 pass to the braiding point 17, at which they are enveloped by the braiding yarns 9, that is to say the sheathing 10, which envelopes the core 12, are braided from the braiding yarn 9. The production of this surgical stitching thread takes place continuously, and is wound up into a thread package 19. 5

The short portion, shown in longitudinal cross-section in Figure 2 of an embodiment of a stitching
10 thread 11 according to the invention has a substantially cylindrical sheathing 10 consisting of a tubular braided structure, in the interior of which lies a core 12 which consists of a number of crimped multifilament yarns which extend axially in the sheathing. 10

The free circumferential surface of this surgical stitching thread is preferably solely constituted by the multifilament yarns of the sheathing. However, it is also possible to provide this sheathing with a
15 finish, which for example has an anti-bacterial action or imparts other desired properties to the stitching thread. 15

The individual multifilament yarns of the sheathings and cores of the known stitching threads set out in Table 1 have so-called protective twists, that is to say a small degree of twist (e.g. 10 to 130 turns/meter, according to the individual count or titre in each instance). Conveniently, this may also be
20 the case with the surgical stitching thread according to the invention. In accordance with a modification of the invention somewhat better smoothness of the surface of the sheathing can be achieved by making the multifilament yarns of the sheathing twist free, that is to say they have no twist at all. If the core has one or more multifilament yarns, this provision may also be made for these yarns. 20

TABLE 1

5107	sheathing braided from uncrimped multi-filament yams			core from non-crimped multi-filament yams
USP-Size	K	Z	Game	N x GT, f GT in dtex
7-0	4	42 to 53	GT 35, f 15 GT 15, f 10	-
6-0	4 to 6	42 to 50	GT 35, f 15 GT 15, f 10	-
5-0	4 to 8	50 to 80	GT 35, f 15 GT 30, f 20	-
4-0	8	59 to 65	GT 49, f 16 GT 76, f 24	-
3-0	8	56 to 68	GT 95, f 24 GT 76, f 24	1 x GT 150, f 24
2-0	6 to 8	50 to 61	GT 190, f 48 GT 76, f 24	2 x GT 80, f 20 (ply yam)
0	8 to 12	55 to 60	GT 190, f 48 GT 111, f 32	-
1	12 to 16	53 to 67	GT 190, f 48	1 x GT 226, f 64
			GT 111, f 32	2 x GT 74, f 18 (ply yam)
2	12 to 16	50 to 67	GT 280, f 72	2 x GT 76, f 18 (ply yam)
			GT 111, f 32	1 x GT 308, f 108
3 and 4	12	50 to 65	GT 280, f 72	3 x GT 180, f 24 (ply yam)
			GT 280, f 50	1 x GT 280, f 50
5	12 to 16	52 to 70	GT 380, f 72	5 x GT 180, f 24 (ply yam)
			GT 340, f 80	3 x GT 455, f 96 (ply yam)
6	12 to 16	52 to 70	GT 380, f 96	6 x GT 180, f 24 (ply yam)
			GT 390, f 66	3 x GT 660, f 20 (ply yam)

TABLE 2

5107	sheathing braided from uncrimped multi-filament yarns				core from doubled (folded), crimped multi-filament yarns		
USP-Size	K	GT (dtex)	f	Z	N	GT (dtex)	f
7—0	8	25	22	8			
6—0	8	25	22	13			
5—0	12	25	22	18			
4—0	12	25	22	20	3	50	24
3—0	12	49	16	18	3	50	24
2—0	16	49	16	23	6	50	24
0	16 or 24	49	16	25	8	50	24
1	18 or 24	49	16	21 or 27	10 or 12	50	24
2	24	49	16	27	12	50	24
3 and 4	20	113	32	25	20	50	24
5	20	113	32	21	30	50	24
6	24	113	32	19	35	50	24
2	18	113	32	21	12	50	24
3 and 4	24	95	24	19	20	50	24
5	24	95	24	19	25	50	24

CLAIMS

1. Surgical stitching thread having a tubular braided sheathing composed of a plurality of multifilament yarns, each of which consists of smooth uncrimped filaments, characterised in that, for reducing the surface roughness of the sheathing, the number of bobbins (K) used for braiding the sheathing is increased in comparison with the known surgical stitching threads, specified in aforesaid Table 1, of the same diameter range (USP-size), and the number of braids (Z) in the sheathing is reduced in comparison with these known surgical stitching threads.
2. Surgical stitching thread of USP-size 7—0 according to claim 1, having its sheathing braided with a number of bobbins K equal to 6, 8 or 10, and with a number of braids Z equal to 8 to 15, in which K is the number of bobbins used for braiding the sheathing and Z is the number of braids per French inch.
3. Surgical stitching thread of USP-size 6—0, according to claim 1, having its sheathing braided with K equal to 8 or 10 and with Z equal to 10 to 20.
4. Surgical stitching thread of USP-size 5—0, according to claim 1, having its sheathing braided with K equal to 10 or 12, and with Z equal to 10 to 20.
5. Surgical stitching thread of USP-size 4—0, according to claim 1, having its sheathing braided with K equal to 10, 12 or 14, and with Z equal to 15 to 25.
6. Surgical stitching thread of USP-size 3—0, according to claim 1, having its sheathing braided with K equal to 10, 12 or 14, and with Z equal to 15 to 25.
7. Surgical stitching thread of USP-size 2—0, according to claim 1, having its sheathing braided with K equal to 12, 14 or 16, and with Z equal to 17 to 27.
8. Surgical stitching thread of USP-size 0, according to claim 1, having its sheathing braided with K equal to 14, 16, 18, 20 or 24, and with Z equal to 17 to 27.
9. Surgical stitching thread of USP-size 1, according to claim 1, having its sheathing braided with

K equal to 18, 20 or 24 and with Z equal to 17 to 27.

10. Surgical stitching thread of USP-size 2, according to claim 1, having its sheathing braided with K equal to 18, 20, 22, 24 or 26, and with Z equal to 17 to 30.

11. Surgical stitching thread of USP-size 3 and 4, according to claim 1, having its sheathing
5 braided with K equal to 18, 10, 22, 24, 26 and with Z equal to 17 to 30.

12. Surgical stitching thread of USP-size 5, according to claim 1, having its sheathing braided with K equal to 18, 20, 22, 24 or 26, and with Z equal to 17 to 30.

13. Surgical stitching thread of USP-size 6, according to claim 1, having its sheathing braided with K equal to 20, 22, 24 or 26, and with Z equal to 17 to 30.

10 14. Surgical stitching thread according to claim 2, having its sheathing braided with K equal to 8, ... 10 and with Z equal to 8.

15. Surgical stitching thread according to claim 3, having its sheathing braided with K equal to 8 and with Z equal to 13.

16. Surgical stitching thread according to claim 4, having its sheathing braided with K equal to 12 and Z equal to 18.

17. Surgical stitching thread according to claim 5, having its sheathing braided with K equal to 12 and Z equal to 20.

18. Surgical stitching thread according to claim 6, having its sheathing braided with K equal to 12 and with Z equal to 18.

20 19. Surgical stitching thread according to claim 7, having its sheathing braided with K equal to 16 20 and with Z equal to 23.

20. Surgical stitching thread according to claim 8, having its sheathing braided with K equal to 16 or 24, and with Z equal to 25.

21. Surgical stitching thread according to claim 9, having its sheathing braided with K equal to 18 or 24, and with Z equal to 21 or 27.

25 22. Surgical stitching thread according to claim 10, having its sheathing braided with K equal to 24 and with Z equal to 27.

23. Surgical stitching thread according to claim 11, having its sheathing braided with K equal to 20 or 24, and with Z equal to 19 or 27.

30 24. Surgical stitching thread according to claim 12, having its sheathing braided with K equal to 20 or 24, and with Z equal to 19 or 21.

25. Surgical stitching thread according to claim 13, having its sheathing braided with K equal to 24 and with Z equal to 19.

35 26. Surgical stitching thread according to any of claims 2 to 5 or 14 to 17, having its sheathing braided from multifilament yarns, each of which has an individual count (titre) of 20 to 30 dtex, preferably of about 25 dtex, and preferably at least 22 filaments.

27. Surgical stitching thread according to any of claims 6 to 10 or 18 to 22, having its sheathing braided from multifilament yarns, each of which has an individual count of 40 to 60 dtex, preferably of about 49 dtex, and preferably at least 16 filaments.

40 28. Surgical stitching thread according to any of claims 11 to 13 or 23 to 25, having its sheathing braided from multifilament yarns, each of which has an individual count of 80 to 120 dtex, preferably 113 dtex, and preferably at least 32 filaments.

29. Surgical stitching thread according to claim 9 or claim 21, having its sheathing braided from multifilament yarns, each of which has an individual count of 60 to 90 dtex, preferably of about 74 dtex, and preferably at least 24 filaments.

45 30. Surgical stitching thread according to any of the foregoing claims, having at least one filament of its sheathing, and preferably all filaments of its sheathing, made of synthetic plastics material.

31. Surgical stitching thread according to any of the foregoing claims, having at least one filament of its sheathing, and preferably all of its filaments, made of metal.

50 32. Surgical stitching thread according to any of the foregoing claims, having at least one filament of its sheathing, and preferably all of its filaments, made of viscose or polyglycolic acid.

33. Surgical stitching thread according to any of the foregoing claims, having at least one filament yarn of its sheathing made of natural silk.

34. Surgical stitching thread according to claim 1, having a USP size of from 7—0 to 3—0, and which exclusively consists of the sheathing.

55 35. Surgical stitching thread according to claim 1, having a USP size of from 4—0 to 6, and in which a core is arranged within its sheathing.

36. Surgical stitching thread according to claim 35, in which its core comprises at least one multifilament yarn, preferably in the form of synthetic plastics material filaments.

60 37. Surgical stitching thread according to claim 35, having a core which consists of one or more monofilaments which extend parallel to the longitudinal axis of the surgical stitching thread and are of elastomeric material, preferably silicone-rubber or polyurethane.

38. Surgical stitching thread according to claim 36, having a core which consists of a plurality of multifilament yarns which are braided so as to form a tube.

65 39. Surgical stitching thread according to claim 36, in which its core consists of a plurality of 65

folded (doubled) multifilament yarns.

40. Surgical stitching thread according to any of claims 36 to 39, in which the filaments of its core are uncrimped.

5 41. Surgical stitching thread according to any of claims 36 to 39, in which at least one filament of its core, and preferably all of its filaments, are crimped. 5

42. Surgical stitching thread according to any of the foregoing claims, in which the number of multifilament yarns of which the sheathing consists, corresponds to the number K of bobbins used for braiding the sheathing.

10 43. Surgical stitching thread according to any of claims 1 to 41, wherein the number of multifilament yarns, of which the sheathing consists, is greater than the number K of bobbins used for braiding the sheathing, this being accomplished by arranging that, when the sheathing is being braided, from at least one bobbin at least two multifilament yarns are guided, doubled (folded) and parallel to one another, to the braiding point. 10

15 44. Surgical stitching thread according to any of the foregoing claims, and of which its free outer surface is solely constituted by the multifilament yarns of the sheathing. 15

45. Surgical stitching thread according to any of claims 1 to 25 or 30 to 44, in which a monofilament or a number of doubled (folded) filaments, which are not twisted round one another, replace at least one multifilament yarn of the sheathing.

20 46. Surgical stitching thread according to any of the foregoing claims, in which the multifilament yarns of the sheathing and/or of the core have a small twist (so-called protective twist). 20

47. Surgical stitching thread according to any of claims 1 to 45, in which the multifilament yarns of the sheathing and/or of the core are twist free (without twist).

48. Surgical stitching thread composed substantially as hereinbefore described by reference to the accompanying Tables 1 and 2 and the drawing.